

FORM PTO-1390 (Modified) (REV 11-98)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER 112740-167
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371			U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR) 09/762739
INTERNATIONAL APPLICATION NO. PCT/DE99/02518	INTERNATIONAL FILING DATE 12 August 1999	PRIORITY DATE CLAIMED 12 August 1998	

TITLE OF INVENTION
CHANGING A FAULTY RADIO CHANNEL

APPLICANT(S) FOR DO/EO/US
Erich Kamperschroer et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
9. ☒ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter
19. ☒ Certificate of Mailing by Express Mail
20. ☒ Other items or information:

Submission of Drawings Fig.s. 1-2 on one sheet

U.S. APPLICATION NO. OF KNOWN SEE 37 CFR 09/762739		INTERNATIONAL APPLICATION NO. PCT/DE99/02518		ATTORNEY'S DOCKET NUMBER 112740-167	
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21. The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :			CALCULATIONS	PTO USE ONLY
<input type="checkbox"/>	Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO	\$1,000.00		
<input checked="" type="checkbox"/>	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO	\$860.00		
<input type="checkbox"/>	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO	\$710.00		
<input type="checkbox"/>	International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4)	\$690.00		
<input type="checkbox"/>	International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4)	\$100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =			\$860.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).			\$0.00	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	6 - 20 =	0	x	\$0.00
Independent claims	1 - 3 =	0	x \$78.00	\$0.00
Multiple Dependent Claims (check if applicable) .			<input type="checkbox"/>	\$0.00
TOTAL OF ABOVE CALCULATIONS			=	\$860.00
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable) .			<input type="checkbox"/>	\$0.00
SUBTOTAL			=	\$860.00
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).			+	\$0.00
TOTAL NATIONAL FEE			=	\$860.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).			<input type="checkbox"/>	\$0.00
TOTAL FEES ENCLOSED			=	\$860.00
			Amount to be:	\$
			refunded	\$
			charged	\$

☒ A check in the amount of **\$860.00** to cover the above fees is enclosed.

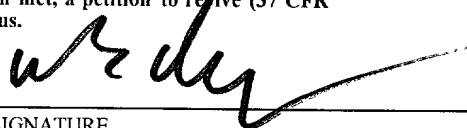
☐ Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **02-1818** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

William E. Vaughan
 Bell, Boyd & Lloyd LLC
 P.O. Box 1135
 Chicago, IL 60690-1135


 SIGNATURE
 William E. Vaughan
 NAME
 39,056
 REGISTRATION NUMBER
 February 12, 2001
 DATE

09/762739

JC02 Rec'd PCT/PTO 12 FEB 2001

CERTIFICATE OF MAILING BY "EXPRESS MAIL" (37 CFR 1.10)Applicant(s): **Erich Kamperschroer et al.**

Docket No.

112740-167

Serial No.

Filing Date

Examiner

Group Art Unit

Invention: **CHANGING A FAULTY RADIO CHANNEL**

I hereby certify that the following correspondence:

International Application as filed, English Translation, amended pages, IDS, PTO 1449, search report, references, preliminary amendment, submission of drawings Figs. 1-2 on one sheets PTO 1390 in duplicate, filing fee \$860.00, postcard

(Identify type of correspondence)

is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to: The Assistant Commissioner for Patents, Washington, D.C. 20231 on

February 12, 2001*(Date)*Julie Alonzo*(Typed or Printed Name of Person Mailing Correspondence)*
*(Signature of Person Mailing Correspondence)*EL704943622US*("Express Mail" Mailing Label Number)*

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IN THE UNITED STATES ELECTED/DESIGNATED OFFICE
 OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
 UNDER THE PATENT COOPERATION TREATY-CHAPTER II

5

PRELIMINARY AMENDMENT

APPLICANT: Erich Kamperschroer et al. DOCKET NO: 112740-167

SERIAL NO: GROUP ART UNIT:

10

EXAMINER:

INTERNATIONAL APPLICATION NO: PCT/DE99/02518

INTERNATIONAL FILING DATE: 12 August 1999

INVENTION: CHANGING A FAULTY RADIO CHANNEL

15 Assistant Commissioner for Patents,
 Washington, D.C. 20231

Sir:

20 Please amend the above-identified International Application before entry
 into the National stage before the U.S. Patent and Trademark Office under 35 U.S.C.
 §371 as follows:

In The Specification:

On page 1, cancel lines 1-3 and substitute the following therefor.

--SPECIFICATION

25

TITLE

**A METHOD FOR CHANGING RADIO CHANNELS IN A RADIO
 COMMUNICATION SYSTEM**

BACKGROUND OF THE INVENTION**Field of the Invention--.**

30

On page 1, line 5, insert --present-- before "invention".

On page 1, line 7, cancel "especially" and substitute therefor
 --particularly--.

On page 1, line 8, insert --both--after “exhibits”.

On page 1, before line 14, insert the following lefthand justified heading

--Description of the Prior Art--

On page 1, line 22, cancel the “,” and substitute therefor a --;--.

5 On page 1, line 22, insert a --,-- after i.e.

On page 1, line 31, cancel “by means of” and substitute therefor --via--.

On page 1, lines 37 and 38, cancel “, therefore,”.

On page 2, line 1, insert --either-- after “and”.

On page 3, line 11, insert a --,-- after “are”.

10 On page 3, line 11, insert a --,-- after “case”.

On page 3, line 22, insert a --,-- after “channels”.

On page 3, line 22, insert a --,-- after “case”.

On page 3, line 24, cancel “in each case”.

On page 3, line 26, cancel “in each case”.

15 On page 3, line 37, insert a --,-- after “is”.

On page 3, line 37, insert a --,-- after “case”.

On page 4, line 10, cancel “usual” and substitute therefor --typical--.

On page 4, line 20, insert a --,-- after “by” and before “in”.

On page 4, line 21, insert a --,-- after “case”.

20 On amended page 5, lines 22-23, cancel “, in which” and substitute therefor
--. In this--.

On amended page 5, line 24, cancel the “-“ and substitute therefor a --,--.

On amended page 5, line 26, cancel the hyphen and substitute therefor a

--,--.

25 On amended page 5, lines 30-31, cancel “based on the object of specifying”
and substitute therefor --, therefore, directed to--.

On amended page 5A, cancel lines 1-3 and substitute the following centered
heading therefor

--SUMMARY OF THE INVENTION--

On amended page 5A, line 4, cancel "A" and substitute therefor
--Accordingly, a--.

On page 6, line 10, insert--present—before "invention".

On page 6, line 14, cancel "a first" and substitute therefor --and--.

5 On page 6, line 23, insert --present--before "invention".

On page 7, line 15, cancel "i.e." and substitute therefor --or--.

On page 7, line 22, insert --of the present invention—after "development".

On page 7, cancel lines 27-31 and substitute the following therefor

10 --Additional features and advantages of the present invention are described
in, and will be apparent from, the following Detailed Description of the Preferred
Embodiments and the Drawings.

DESCRIPTION OF THE DRAWINGS--.

On page 7, line 34, cancel "already".

On page 7, line 35, cancel "above," and substitute therefor --herein;--.

15 On page 7, line 36, cancel "according to" and substitute therefor --of--.

On page 7, line 37, insert --present-- before "invention".

On page 8, before line 1, insert the following centered heading

--DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS--.

On page 8, line 7, cancel "by means of" and substitute therefor --via--.

20 On page 8, line 16, cancel the ",", and substitute therefor a --;--.

On page 8, line 16, insert a --,-- after "example".

On page 8, line 30, insert a --,-- after "example".

On page 9, line 1, insert --present-- before "invention".

On page 9, line 4, insert --present-- before "invention".

25 On page 9, line 8, insert --present-- before "invention".

On page 9, line 26, insert --present—before "invention".

On page 10, line 4, cancel "can".

On page 10, line 4, insert --can--after "also".

On page 10, line 7, insert--present--before "invention".

On page 10, line 9, cancel the “,” and substitute therefor a --;--.

On page 10, line 9, insert a --,-- after “example”.

On page 10, line 11, insert --present--before “invention”.

On page 10, line 12, cancel “can”.

5 On page 10, line 12, insert --can--after “also”.

On page 10, after line 18, insert the following paragraph

--Although the present invention has been described with reference to specific embodiments, those of skill in the art will recognize that changes may be made thereto without departing from the spirit and scope of the invention as set forth in the hereafter appended claims.--

10

On page 13, (last page) cancel lines 1-3 and substitute the following centered heading therefor

--ABSTRACT OF THE DISCLOSURE--

On page 13, line 6, cancel “is described in which” and substitute therefor

15 --wherein--.

On page 13, line 8, cancel “(D_a). The” and substitute therefor --, and the--.

On page 13, line 8, cancel “(D_n)”.

On page 13, line 10, cancel “(D_a)”.

On page 13, line 10, cancel “(t7),” and substitute therefor --wherein--.

20

On page 13, line 11, cancel “(f)”.

On page 13, line 11, cancel “remaining” and substitute therefor

--remains--.

On page 13, cancel line 13.

In the Claims:

25 On page 11, cancel line 1 and substitute the following lefthand justified heading therefor

--We Claim As Our Invention:--

Please cancel claims 1-6, without prejudice and substitute the following claims therefor:

7. A method for changing radio channels in a mobile radio communication system, the method comprising the steps of:

providing an existing duplex radio link having both a first physical radio channel for transmitting communication information via an air interface, and a
5 second physical radio channel for transmitting communication information in an opposite direction to the first physical radio channel via the air interface; and

changing, upon a disturbance of the duplex radio link, only the disturbed one of the first physical radio channel and the second physical radio channel wherein the undisturbed one of the first physical radio channel and the second physical radio
10 channel is retained.

8. A method for changing radio channels in a mobile radio communication system as claimed in claim 7, wherein the mobile radio communication system exhibits a TDMA (Time Division Multiple Access) component in which only a time slot of the disturbed one of the first physical radio
15 channel and the second physical radio channel is changed.

9. A method for changing radio channels in a mobile radio communication system as claimed in claim 7, wherein the mobile radio communication system an FDMA (Frequency Division Multiple Access) component in which only a carrier frequency of the disturbed one of the first physical radio
20 channel and the second physical radio channel is changed.

10. A method for changing radio channels in a mobile radio communication system as claimed in claim 7, wherein the radio communication system exhibits both a TDMA multiple access component and an FDMA multiple access component in which both a time slot and a carrier frequency of the disturbed
25 one of the first physical radio channel and the second physical radio channel is changed.

11. A method for changing radio channels in a mobile radio communication system as claimed in claim 7, wherein the radio communication system exhibits a CDMA (Code Division Multiple Access) component in which a

transmission code of the disturbed one of the first physical radio channel and the second physical radio channel is changed.

12. A method for changing radio channels in a mobile radio communication system as claimed in claim 7, wherein each available radio channel of the mobile radio communication system can be used both as a first physical radio channel and as a second physical radio channel.

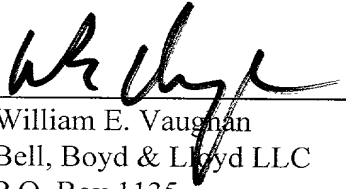
R E M A R K S

- The present amendment makes editorial changes and corrects typographical errors in the specification in order to conform the specification to the requirements of the United States Patent practice. No new matter is added thereby. Original claims 1-6 have been canceled in favor of new claims 7-12. Claims 7-12 have been presented solely because the revisions by bracketing and underlining which would have been necessary in claims 1-6 in order to present those claims in accordance with preferred United States Patent practice would have been too extensive, and thus would have been too burdensome. The amendment is intended for clarification purposes only and not for substantial reasons related to patentability pursuant to 35 U.S.C. §§101, 102, 103 or 112. Indeed, the cancellation of claims 1-6 does not constitute an intent on the part of the Applicant to surrender any of the subject matter of claims 1-6.

Early consideration on the merits is respectfully requested.

Respectfully submitted,

5



(Reg. No. 39,056)

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T06T90" 6E29/60

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JC02 Rec'd PCT/PTO 1 2 FEB 2001

Description

Changing a disturbed radio channel

5 The invention relates to a method for changing
radio channels in a radio communication system,
especially in a mobile radio system, in which an
existing duplex radio link exhibits a first radio
channel for transmitting communication information via
10 an air interface and a second radio channel for
transmitting communication information in the opposite
direction to the first radio channel via the air
interface.

15 It is known to use physical channels in radio
communication systems for transmitting communication
information. By using these physical channels, the
communication information, especially speech data or
computer data, is transmitted from a first radio
station to a second radio station via an air interface.
20 In the case of duplex radio links, communication
information is also transmitted in the opposite
direction via the same air interface, i.e. in the
direction from the second radio station to the first
radio station.

25 Parameters of the physical channels are, for
example, a certain timeslot in a TDMA (Time Division
Multiple Access) radio communication system, a certain
carrier frequency which is used in the transmission of
the communication information in an FDMA (Frequency
30 Division Multiple Access) radio communication system,
and a certain code by means of which the communication
information is coded for the radio transmission in a
CDMA (Code Division Multiple Access) radio
communication system. Combinations of the known
35 multiple access methods TDMA, FDMA and CDMA are
possible. In a combined TDMA/FDMA radio communication
system, for example, a physical radio channel is,
therefore,

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defined by its timeslot and its radio frequency or carrier frequency, respectively.

In known mobile radio systems, especially in the GSM (Global System for Mobile Telecommunication), the radio channels via which communication information can be transmitted between a certain base station and a certain mobile station are issued centrally by a coordination unit. The coordination unit selects the individual controls of the base stations operated in the GSM and assigns to them the radio channels.

However, radio communication systems are also known which operate in a so-called uncoordinated mode. In such systems, the radio channels are not issued centrally for the entire system but, instead, the radio stations involved in a radio link select their own radio channels from an existing pool of available radio channels. An example of a radio station operating in uncoordinated mode is the mobile station of a mobile radio system according to the DECT standard.

As already mentioned above, duplex radio links are set up for transmitting bidirectional data, voice information or communication information of other services via an air interface in known radio communication systems, especially in a GSM, a system according to the DECT standard or in a future UMTS (Universal Mobile Telecommunication System). In particular, the TDD (Time Division Duplex) method is known in which a first radio channel and a second radio channel of the same duplex radio link use different timeslots of the same carrier frequency. In this arrangement, the first radio channel represents the radio link in one direction and the second radio channel represents the radio link in the opposite direction. Furthermore, the FDD (Frequency Division Duplex) method is known in which the first radio channel of the duplex radio link uses a first

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radio frequency and the second radio channel of the duplex radio link uses a second, different radio frequency.

In the duplex radio links of known radio communication systems, there is a fixed association between each pair of the available physical radio channels. In a DECT mobile radio system, for example, in each case 24 timeslots of 10 carrier frequencies are available for the physical radio channels. In this arrangement, the first 12 timeslots of the carrier frequencies are in each case reserved for the downlink radio link between a base station and a mobile station. Timeslots 13 to 24 of the carrier frequencies are reserved for the uplink radio links in the opposite direction from the mobile station to the base station. However, the fixed association in the case of each pair of radio channels does not allow arbitrary combinations of a downlink radio channel and an uplink radio channel in a duplex radio link but decides that each downlink radio channel is permanently associated with a certain uplink radio channel. In the case of the DECT system, the two associated radio channels in each case use the same carrier frequency, the downlink radio channel and the uplink radio channel also in each case using the timeslot which has the same ordinal number in the available 12 timeslots which are in each case allocated to the downlink radio channels and the uplink radio channels. For example, the first timeslot of a carrier frequency is thus permanently joined to timeslot 13, the second timeslot is permanently joined to timeslot 14, and so on.

In GSM, too, there is a fixed association between the uplink radio channel and the downlink radio channel of a duplex radio link. In distinction from the DECT systems, the associated radio channels use different radio frequencies. However, a pair of associated radio channels is in each case allocated to the timeslot having the same ordinal number in the two radio frequencies used. Thus,

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for example, in each case timeslot 1 of two radio frequencies or timeslot 2 of two radio frequencies and so on is used by a duplex radio link.

During the operation of existing duplex radio links, disturbances which can lead to a loss of the communication information transmitted can occur, for example, due to interference, multi-path propagation and/or fading of communication signals. To prevent further disturbances or to eliminate the disturbance of the duplex radio link, it is usual to change the physical radio channels of the duplex radio link involving both the radio channel for one direction of transmission and the radio channel for the opposite direction.

This situation is explained in greater detail in Figure 1 of the attached drawing. Figure 1 shows a total of eight physical radio channels which exist in a radio communication system with TDMA multiple access components. The individual physical radio channels are defined by the common carrier frequency f and by in each case one of the eight timeslots $t_1, t_2 \dots t_8$. Before a disturbance occurs, an existing duplex radio link uses radio channel D_a with the frequency/timeslot combination f/t_1 in the downlink direction and radio channel U_a with the frequency/timeslot combination f/t_5 in the uplink direction. Then a disturbance occurs, for example in the downlink radio channel D_a which is subjected by the mobile station due to an unacceptably high bit error rate. The base station then determines a new available downlink radio channel by accessing a list of the available radio channels which carries an entry for each radio channel whether the radio channel is also disturbed or otherwise used.

In this manner, the mobile station determines the radio channel having the frequency/timeslot combination f/t_3 as a possible new

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downlink radio channel D_n and informs the base station that a change to this radio channel will be initiated and, respectively, that the base station should transmit on radio channel D_n after the change.

- 5 According to defined protocols, both the change of the downlink radio channel from radio channel D_a to radio channel D_n and the change of the uplink radio channel from radio channel U_a to radio channel U_n is then performed. The vertical line between the radio channels
10 having timeslots t_1 to t_4 and between the radio channels having timeslots t_5 to t_8 indicates that the radio communication system under consideration is a system in which the first four radio channels of the carrier frequency f are exclusively used for downlink
15 connections and the second four radio channels are exclusively used for uplink radio links.

- From EP 0 399 612 A2, a method and a system for data transmission via a TDD channel is known in which at least one bidirectional (duplex) voice channel
20 formed of two non-adjacent timeslots is provided for a data transmission between a first radio transceiver station and a second radio transceiver station, in which arrangement, when two or more duplex voice channels are used - if more data packets are to be
25 transmitted in one direction of transmission than in the opposite direction - timeslots of the duplex voice channels allocated to the opposite direction and unused are released and made available for the transmission of the data packets in the direction of transmission.

- 30 The present invention is based on the object of specifying a method for changing a radio channel of the type initially mentioned, in which the frequency spectrum of the available radio channels can be utilized as well as possible and in which the change
35 can be performed in the shortest possible time.

The object is achieved by a method having the features of claim 1. Further developments are the subject matter of the dependent claims.

5 A central idea of the present invention is that
only the disturbed first or disturbed second radio
channel is changed in the case of a disturbance of the
existing duplex radio link. This central idea is based
on the finding that in many cases, only one of the
currently used radio channels is disturbed in the case
10 of a disturbance of the duplex radio link. To eliminate
the disturbance as quickly as possible, only the
disturbed radio channel is, therefore, changed. As a
rule, changing only one radio channel is associated
with a much smaller exchange of signaling information
15 via the air interface

than when a number of radio channels are changed.

The disturbed duplex radio link can be, in particular, a radio link which uses not only in each case one radio channel for the two transmission
5 directions but, for example, a number of radio channels for transmitting computer data in the downlink direction. Furthermore, the number of radio channels used in one direction can differ from the number of the radio channels used in the opposite direction.

10 The method according to the invention is advantageously used in a number of different multiple access methods or combinations of these multiple access methods.

In a first embodiment, the radio communication
15 system exhibits a TDMA multiple access component and only the timeslot of the disturbed first radio channel or of the disturbed second radio channel is changed.

In another embodiment, the radio communication system exhibits an FDMA multiple access component and
20 only the carrier frequency of the disturbed first radio channel or of the disturbed second radio channel is changed.

The method according to the invention can be used particularly advantageously if the radio
25 communication system exhibits both a TDMA and an FDMA multiple access component and if both the carrier frequency and the timeslot of the disturbed first radio channel or of the disturbed second radio channel can be changed. This provides a multiplicity of existing radio
30 channels of the radio communication system for the selection of a new radio channel when the disturbed radio channel is changed.

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5 The available radio channels are used more effectively than in known radio communication systems with a fixed association of duplex radio channels even if the radio communication system only offers radio channels either as first radio channel for one direction of transmission or as second radio channel for the opposite direction.

10 However, it is proposed not to perform such a separation between first and second radio channels but to form only a single pool of available physical radio channels from which, if necessary, a radio channel can be taken which is then used either as first radio channel or as second radio channel.

15 As can be seen immediately, the spectral efficiency, i.e. the efficiency in using the available frequency spectrum, is much greater in this case than in known methods which, due to the association between the duplex radio channels, only allow a simultaneous change of both channels so that a radio channel which 20 may be undisturbed also has to be changed and cannot be used any longer.

25 In a further development, the radio communication system exhibits a CDMA multiple access component and the transmission code of the disturbed first radio channel or of the disturbed second radio channel is changed.

30 The invention will now be explained in greater detail with reference to an exemplary embodiment, referring to the attached drawing. However, the invention is not restricted to this exemplary embodiment. In the individual figures of the drawing:

35 Figure 1 shows a change of radio channels in accordance with a known method as already explained above, and

Figure 2 shows an exemplary embodiment according to the method according to the invention.

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Similar to what has already been explained with reference to Figure 1, Figure 2 shows a radio communication system with a TDMA multiple access component. It shows eight timeslots $t_1, t_2 \dots t_8$ of a carrier frequency f or, respectfully, the physical radio channels defined in this way. In distinction from the radio communication system described by means of Figure 1, however, there is no fixed association between the radio channels which can be used in one and the same duplex radio link. Instead, all available physical radio channels of the system form a common pool of radio channels from which, if necessary, a radio channel can be taken and used in a radio link.

Thus, for example, it is also possible to take from the pool not only radio channels for duplex radio links but also for unidirectional links, for example for transmitting signaling information from a base station to a multiplicity of mobile stations. The term "unidirectional" is not intended to mean that the information is only to be transmitted in one spatial direction but, if one or more air interfaces are taken into consideration, only in each case one of the two directions of transmission of the respective air interface.

In the case shown in Figure 2, there is initially a duplex radio link of a mobile radio system, the downlink connection being established via the radio channel D_a and the uplink radio link being established via the radio channel U . A disturbance of the radio channel D_a then occurs, for example due to multipath propagation. The mobile station detects the disturbance and selects the new downlink radio channel D_n from the pool of available radio channels. It informs the base station of the intended change and the base station adjusts the transmission of communication information to the corresponding new timeslot t_7 in the course of the changing procedure then initiated.

As already emphasized, the invention is not restricted to the exemplary embodiment explained with reference to Figure 2. Instead, the method according to the invention is advantageously used especially in the case of a possibility of a change of both the radio frequency and of the timeslot of the disturbed radio channel. In general, the advantages of the method according to the invention can be enumerated as follows which, however, does not conclude the enumeration:

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- If it is not both the first radio channel and the second radio channel of an existing duplex radio link which are disturbed, it is not necessary to change the first and the second radio channel. The undisturbed radio channel or the undisturbed radio channels, respectively, are, therefore, still used so that the available frequency spectrum is used more efficiently compared with the known methods.

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20 - Each change of a radio channel can create interference on other radio links in that the electromagnetic waves radiated on the new radio channel have a disturbing effect on other radio links which may be quite a distance in space. Thus, the lower rate of channel changes in the method according to the invention also reduces the probability of disturbing other radio links more than proportionally since a disturbance produced by a change of channels, and the further change of channels triggered by this, in turn, entails further disturbance of a radio link with a certain probability.

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- Changing only one radio channel requires less time expenditure in the search for a new undisturbed radio channel and in transmitting and evaluating signaling information which is transmitted between radio stations involved.

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- Because of the reduced amount of work having to be expended in the radio stations involved, the hardware and software resources of the radio stations can also be correspondingly reduced in size.

The method according to the invention can be used, in particular, for the so-called uncoordinated operation in a future mobile radio system, for example the UMTS (Universal Mobile Telecommunication System) in TDD (Time Division Duplex) mode. However, the invention can also be advantageously used in other systems, for example in systems which are operated in accordance with the DECT standard, in relinquishing the fixed association of a pair of physical radio channels in each case and only changing the disturbed first radio channel or the disturbed second radio channel in the case of a disturbed duplex radio link.

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Patent Claims

1. A method for changing radio channels in a radio communication system, especially in a mobile radio system, in which an existing duplex radio link exhibits
- a first physical radio channel (D_a) for transmitting communication information via an air interface and
 - a second physical radio channel (U) for transmitting communication information in the opposite direction to the first physical radio channel via the air interface
- characterized in that, only the disturbed first radio channel (D_a) or only the disturbed second physical radio channel (U) is changed in the case of a disturbance of the duplex radio link, undisturbed physical radio channels being retained.
2. The method as claimed in claim 1, in which the radio communication system exhibits a TDMA (Time Division Multiple Access) component and in which only the timeslot (t_1) of the disturbed first radio channel (D_a) or of the disturbed second radio channel is changed.
3. The method as claimed in claim 1, in which the radio communication system exhibits an FDMA (Frequency Division Multiple Access) component and in which only the carrier frequency of the disturbed first radio channel or of the disturbed radio channel is changed.
4. The method as claimed in claim 1, in which the radio communication system exhibits both a TDMA multiple access component and an FDMA multiple access component and in which both the timeslot and the carrier frequency of the disturbed first radio channel or of the disturbed second radio channel is changed.
5. The method as claimed in one of claims 1 to 4,

in which the radio communication system exhibits a CDMA (Code Division Multiple Access) component and in which the transmission code of the disturbed first radio channel or of the disturbed second radio channel is changed.

6. The method as claimed in one of claims 1 to 5, in which each available radio channel (D_a , D_n , U) of a radio communication system can be used both as first radio channel (D_a , D_n) and as second radio channel (U).

Abstract

Changing a disturbed radio channel

A method for changing only one radio channel of an existing duplex radio link is described in which the radio channel changed or to be changed is the disturbed radio channel (D_a). The new radio channel (D_n) exhibits, for example in comparison with the disturbed radio channel (D_a), only a different timeslot (t_7), the radio frequency (f) remaining the same.

(Figure 2)

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Fig. 1

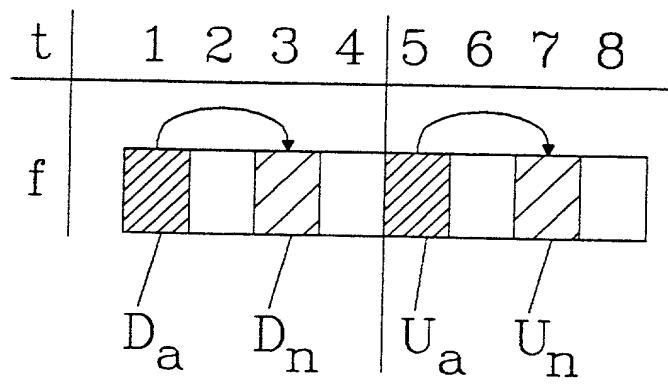
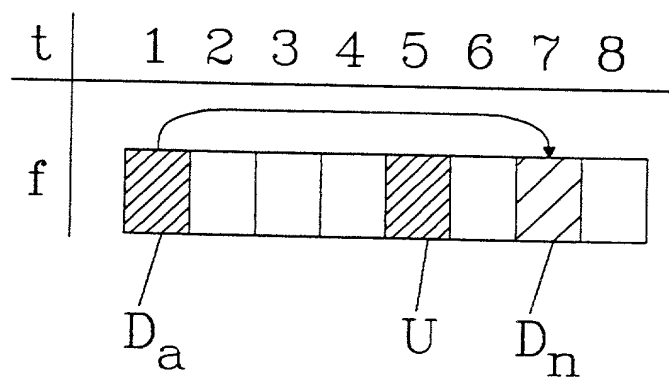


Fig. 2



Declaration and Power of Attorney For Patent Application

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Wechsel eines gestörten Funkkanals

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the specification of which

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I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

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(if applicable)

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Priorität beansprucht

Priority Claimed

<u>198 36 576.4</u>	<u>Germany</u>	<u>12. August 1998</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(Number)	(Country)	(Day Month Year Filed)	Yes	No
(Nummer)	(Land)	(Tag Monat Jahr eingereicht)	Ja	Nein
<u> </u>	<u> </u>	<u> </u>	<input type="checkbox"/>	<input type="checkbox"/>
(Number)	(Country)	(Day Month Year Filed)	Yes	No
(Nummer)	(Land)	(Tag Monat Jahr eingereicht)	Ja	Nein
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(Nummer)	(Land)	(Tag Monat Jahr eingereicht)	Ja	Nein

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<u> </u>	<u> </u>	<u> </u>	<u> </u>
(Application Serial No.)	(Filing Date)	(Status)	(Status)
(Anmeldeseriennummer)	(Anmeldedatum)	(patentiert, anhangig, aufgegeben)	(patented, pending, abandoned)
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(Application Serial No.)	(Filing Date)	(Status)	(Status)
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And I hereby appoint

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